TROPHIC ECOLOGY OF THE SPOTTED FLYCATCHER *MUSCICAPA STRIATA* DURING THE BREEDING PERIOD IN ALGERIA

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RÉSUMÉ. — *Écologie trophique du Gobemouche gris* Muscicapa striata *en période de reproduction en Algérie*. — L'étude du régime alimentaire du Gobemouche gris *Muscicapa striata*, visiteur d'été nicheur en Algérie, a été conduite de mai à octobre 1994 et de mai à septembre 1995 à El Harrach, au sud-est d'Alger, à partir de l'analyse de 356 fientes. Au total, 1889 proies appartenant à 197 taxons ont été identifiées à divers niveaux taxinomiques, variant de l'ordre à l'espèce. Le régime alimentaire est fondé sur les insectes, qui ont représenté en moyenne 95,8 % des proies ingérées par les oiseaux durant les deux saisons de reproduction 1994-1995. Les arachnides, gastropodes, crustacés et myriapodes n'ont été capturés qu'occasionnellement, et de ce fait représentés par des effectifs négligeables. Parmi les Insectes, les Hyménoptères représentaient 48,3 % des proies, dont 25,6 % de fourmis. Avec respectivement 17,5, 12,5 et 11,4 % des proies, les Coléoptères, Diptères et Hémiptères occupaient une place secondaire. Les autres groupes taxinomiques n'étaient que très faiblement représentés et capturés occasionnellement. Les espèces consommées différaient selon les saisons et les années, selon la disponibilité et la phénologie locales des proies. Dans la région d'Alger comme ailleurs, le Gobemouche gris apparaît comme une espèce assez opportuniste qui, lorsque les proies sont abondantes, sélectionne certaines, mais sait les remplacer par d'autres lorsqu'elles sont rares.

SUMMARY. — The diet of the Spotted Flycatcher *Muscicapa striata,* a breeding migratory species in Algeria, was studied from May to October 1994 and from May to September 1995 at El Harrach, a locality south-east of Algiers. It was based mainly on insects, which represented 95.8% of the 1889 food items recovered from 356 faeces. 196 taxa were identified at different taxonomic levels, from order to species. Arachnida, Gastropoda, Crustacea and Myriapoda were only occasionally captured and hence slightly represented. Hymenoptera dominated (48.3% of individual insects, 25.6% being ants), followed by Coleoptera (17.5%), Diptera (12.5%) and Hemiptera (11.4%). Other orders were few in terms of preys. They seemed to be captured when the Spotted Flycatcher got an opportunity to do so. This study shows annual and monthly variations of the species consumed, indicating a high-level of plasticity in the diet. These variations correspond to the local availability and phenology of preys. In the suburban area of Algiers like elsewhere, the Spotted Flycatcher appears to be an opportunist feeder which, when preys are abundant, selects those that best fit its nutritional requirements, but which can use others and become more eclectic when food becomes scarce.

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The Spotted Flycatcher *Muscicapa striata* is a rather common summer breeding visitor in the clear wooded parts of northern Algeria (Cork oak stands, olive plantations, artificial stand of eucalyptus, parks and gardens, etc.) where it is present from mid April or May to August / September (Heim de Balsac & Mayaud, 1962; *obs. pers.*). It extends up to 2200 m in Djebel Chélia, in the massif of Aurès (Schoenenberger, 1972 *in* Ledant *et al.*, 1981). Southwards it appears more localized but still reaches the Oases (Heim de Balsac & Mayaud, 1962; Zink, 1975; Biebach, 1985; Fransson, 1986; Isenmann, 1989; Isenmann & Moali, 2000; Moali & Isenmann, 2000; Isenmann *et al.*, 2005). It winters in equatorial and southern Africa, and the European populations pass through North Africa from April to June, as well as August to November. Besides, it seems to stop more frequently in North Africa than many other long-distance migrants which cross the Mediterranean and the Sahara more or less directly (Heim de Balsac & Mayaud, 1962; Lombard, 1965; Laferrère, 1968; Erard & Larigauderie, 1972; Erard, 1987, 1990; Bairlein 1988a,b; Erard *et al.*, 1997; Thévenot *et al.*, 2003).

Globally the diet of the Spotted Flycatcher is rather little documented, if we except some works done by Davies (1976, 1977) in England, Alatalo & Alatalo (1979) in Finland and Bannikova (1986) in Kazakhstan. To our knowledge, no study had been previously undertaken on this species in North Africa. The present study aims to identify taxa consumed by this species during its stay in Algeria.

MATERIAL AND METHODS

Study area

The study was conducted at El Harrach (3° 08' E; 36° 43' N), the field station of the National Institute of Agronomy, located at 50 m of altitude, south-east of Algiers, between the plate of Belfort and the Eastern part of Mitidja. This station extends approximately over 16 ha. Its septentrional part, which covers 10 ha, is occupied by scattered university buildings, alternating with lawns and various plant formations. The southernmost part (6 ha) is made up of small parcels of meadows. This field, formerly rural, is now almost wrapped in the urban area of an expanding city. The hunting grounds of the Spotted Flycatcher include thickets, the botanical garden, the accesses of the university buildings and the agricultural field (market gardenings and fruit-bearing mainly). It is subjected to a Mediterranean subhumid bioclimat with a soft winter, although it currently crosses a multiannual dryness period.

Collection and analyses of faeces

On the whole 191 faeces of adult Spotted Flycatchers were collected between May 1 and October 30, 1994 and 165 between May 1 and September 30, 1995, at a rate of 33 faeces per month, except in September 1995 when we found only 26 samples because the species left in post-nuptial migration earlier on that year than on the previous one. Faeces were collected beneath two tree perches which were regularly attended by a pair of Spotted Flycatchers, a Cork oak *Quercus suber* located in the botanical garden and a Sansho *Schinus molle* grown in the southern lawn of the field. We thus followed a pair of flycatchers in 1994 and another one in 1995. There were also migrants but both trees were mainly frequented by the followed nesting flycatchers. There were other pairs in the area with a density of 5.25 pairs / 10ha in 1995 (measured by the quadrats method).

The collected faeces were separately stored in numbered bags with precise information on date and place of collection. At the time of the examination, each one was put in a Petri dish and soaked with ethanol at 95° during a few minutes. This made possible to soften the agglomerate of sclerified parts and plant remains, as well as the inorganic contents, and thus facilitated the separation of the various fragments. Once dilacerated and dry, these elements were spread over the surface of the Petri dish. The various animal and plants components were then identified and counted under a binocular magnifying glass.

Determination of the faeces' components

The determination of Arthropods and Molluscs was made by comparing the parts found in the faeces with specimens of the collection of the National Institute of Agronomy in El Harrach, or recently collected in the field. It was not always possible to identify the items at the species level because of the bad conditions, and particularly of the high fragmentation of the chitinous parts. We grouped them into Orders or Families, even if more than one species could be present in our samples. With regard to the plant fraction, we especially identified fruits, also by comparison with a local reference collection.

Sampling of potential prey species

A sampling of potential prey species for the Spotted Flycatcher was led in the botanical garden of the National Institute of Agronomy in El Harrach in only one station, around one of the tree-perches attended by these birds. As this species feeds primarily on flying insects, only one sampling technique was used, that of mowing (Lamotte & Bourlière, 1969). The harvest of the insects was made each time by carrying out 10 series of 10 mowing hauls, which would correspond to 1 m^2 of sampled area (Doumandji, c*om.pers.*). We carried out ten series of mowing per month between May 1 and October 30, 1994. Although these samplings didn't allow to compare what would have been available in the field to what was found in the faeces, they were useful for the identifications of food remains in the faeces. Concerning the hunting behaviour, the Spotted flycatcher can make as well sit-and-wait flycatching (the most common technique) as hover-gleaning; it can also drop to catch a prey on the ground or on grasses (case of Gastropods "grit"), but this is very rare.

RESULTS

Total composition of spotted flycatcher's diet

We identified a total of 1889 preys in the 356 faeces (Appendix). They include 196 taxa (179 in 1994, 124 in 1995) representing 188 Insecta, 4 Arachnida, 2 Gastropoda, 1 Shellfish and 1 Myriapoda. With a percentage of 96%, the insects make an overwhelming numerical majority, whereas the other classes, occasionally captured, are represented by rather negligible numbers. Among Insects, Hymenoptera dominate largely, with 70 taxa representing about half of the captures (Appendix); they are primarily Formicidae and Apidae, which are very abundant in the study area. With 20 species the former represent almost the quarter of the total of the captures, and the latter about 6%. The absence of domestic bees is remarkable, just like the good representation of the wild bees. Three other orders, Coleoptera, Diptera and Hemiptera are rather well represented, with frequencies of occurrence ranging between 11 to 18% (Tab. I); the other insect orders include only rare preys.

TABLE I

Annual fluctuations of the principal preys of the Spotted Flycatcher Muscicapa striata *by systematic orders and classes in 1994 and 1995 in the study area near Algiers*

Years	1994	1995	1994 /95
Taxa	n%	n%	n%
Arachnida	1.3	3.7	2.3
Other invertebrates non-insects	2.1	1.6	1.1
Insecta	96.6	94.7	95.8
Hymenoptera	53.1	41.7	48.3
Coleoptera	17.9	17	17.5
Diptera	11.2	14.3	12.5
Hemiptera	9.1	14.5	11.4
Lepidoptera	2	3.8	2.8
Other orders of insects	3.3	3.4	3.4
Total	100	100	100

n%: relative abundance of the taxon considered.

We also identified 79 fruit remains (Appendix) belonging to eight species (seven in 1994 and five in 1995). In almost two-thirds of the cases, they were fruits of the Tropical fig *Ficus retusa,* as much in 1994 as in 1995. The Bay-tree chock *Viburnum tinus* accounted itself for approximately a tenth of the fruits in 1994, but the double in 1995. The other species were only weakly represented.

Average prey and taxa numbers varied much between months as well as between years (Tabs. II & III), indicating significant levels of plasticity in the diet. This is to be put in relation with the diversity of the potential preys on the spot, and the variations of their abundance.

In 1994, the number of preys per faeces presented two maxima, in May and in June (CV = 28). In 1995, the number of preys per faeces presented also two maxima, in May and in August (CV = 12, Tab. II). Between these two peaks one observed a very clear minimum in July, and another one in June.

TABLE II

Monthly fluctuations of the average number of preys and taxa per faeces of the Spotted Flycatcher Muscicapa striata *in 1994 and 1995 near Algiers*

Parameters	Months Years	V	VI	VII	VIII	IX	X	m	Σ	CV
Number of preys	1994	293	212	163	191	176	101	189.3	63.1	33
	1995	175	145	156	194	164	166.8	18.8	11	175
Number of taxa	1994	87	79	71	70	71	45	70.5	14.1	20
	1995	52	53	61	71	50	57.4	8.7	15	52
Number of preys per faeces	1994	8.9	6.4	4.9	5.8	5.3	3.9	5.9	1.7	28
	1995	5.3	4.4	4.7	5.9	5.3	-	5.0	0.6	12
Number of taxa per faeces	1994	2.6	2.4	2.1	2.1	2.1	1.7	2.2	0.3	13
	1995	1.6	1.6	1.8	2.1	1.5	-	1.7	0.2	11

The number of faeces analysed was 33 per month, except in October 1994, when it was 26; m = average general, σ = standard deviation of the average, CV = coefficient of variation of the general average in%.

One can also notice that the average number of preys per faeces was higher in May in 1994 and in August in 1995. On the contrary, the number of taxa per faeces was always weak, its monthly average ranged between 1.5 and 2.6, and varied only slightly, decreasing regularly in 1994 and passing by a less marked maximum in August 1995. There is no significant relation between the number of taxa per faeces and the number of preys per faeces ($\alpha = 5\%$) in 1994 ($r = 0.52$) and in 1995 ($r = 0.49$).

Overall, Spotted Flycatcher's diet didn't differ quantitatively between 1994 and 1995 (Tab. I), in particular the proportion of Insects was about the same in both years ($\alpha = 5\%$).

Whichever month or year, Insects represented the immense majority of the preys, their proportion never fell below 90% (Tab. III), and their number didn't vary significantly from one month to another (C.V.= 1 to 3%). The other classes of invertebrates appeared only irregularly, and always in very small percentages. Among the Insects, Hymenopterans were by far the preferred, representing more than half of the preys on general average in 1994 and the two fifths in 1995. They were the most consumed preys whichever month, and any fall of their number was compensated by a greater number of preys of other kinds, particularly Coleopteras, Dipteras and Hemipteras. The amplitude of the number fluctuations of the Invertebrates non-Insects is larger in 1995 than in 1994 (Tab. III). One notices that Arachnids are better represented in 1995 than in 1994, while remaining far from numerous. There is a significant dependence between lines (years) and columns (taxa) ($\alpha = 5\%$, $\chi 2$).

In addition to the invertebrates, Spotted Flycatchers very regularly consumed a small quantity of fruits (4%, Tab. I, Appendix). For all the period of study, the most consumed fruits were without question those of the Tropical fig-tree *F. retusa*. In 1994, their number presented two peaks of abundance, in May and August. On the contrary, in 1995, it is in June that they were consumed; after that their importance decreased regularly. The other species were consumed only irregularly and in small quantity (Tab. IV), except *Viburnum tinus* in August and September 1995 and *Morus nigra* in June and July 1994. One can notice that when the importance of the figs decreases that of other fruits increases.

TABLE III

Monthly fluctuations of the diet of the Spotted Flycatcher Muscicapa striata *in 1994 near Algiers expressed as a monthly percentage of the number of preys*

Taxon	Months Years	V	VI	VII	VIII	IX	X	m	σ	CV
Arachnida	1994	1.4	0	1.2	2.1	1.1	3	1.5	1	66
	1995	1.1	2.1	5.1	5.2	3.7	-	3.4	1.8	52
Other non-insect	1994	3.4	1.4	1.2	0	0.6	7	2.2	2.5	114
invertebrates	1995	1.7	4.1	1.9	0	0.6	-	1.6	1.5	94
Insecta	1994	95.2	97.6	97.5	97.9	98.3	90.1	96.1	3.1	3
	1995	97.1	93.8	92.9	94.8	95.7	-	94.9	1.6	1
Hymenoptera	1994	57.3	61.3	53.4	49.7	47.7	38.6	51.3	8	15
	1995	42.3	41.4	36.5	47.9	37.8	-	41.2	4.5	10
Coleoptera	1994	20.1	14.6	14.7	15.2	19.3	26.7	18.4	4.7	25
	1995	21.7	13.1	14.7	22.7	14.6	-	17.4	4.5	25
Diptera	1994	7.2	10.8	12.3	14.1	15.3	7.9	11.3	3.3	29
	1995	17.1	20.7	16	6.2	14	-	14.8	5.4	36
Hemiptera	1994	6.8	7.1	13.5	13.6	9.1	5.0	11.8	3.6	30
	1995	10.9	10.3	18.6	14.4	18.3	-	14.5	3.9	26
Lepidoptera	1994	0	0	2.5	2.1	5.1	3.0	2.1	1.9	90
	1995	0	5.5	4.5	2.6	6.1	-	3.7	2.5	67
Other orders	1994	3.7	0	1.2	3.1	1.8	8.9	3.1	3.1	100
of insects	1995	2.9	2.8	2.5	0.5	4.8	-	2.7	1.5	55
NR	1994	293	212	163	191	176	101	189.3	63.1	33
	1995	175	145	156	194	164	-	166.8	18.8	11

NR = a number of preys per month, m = arithmetic mean, σ = standard deviation of the average, CV = coefficient of variation in %.

TABLE IV

Fruits or fragments of fruits per month and per faeces of Muscicapa striata *in 1994 and 1995 near Algiers*

Species	Months Years	V	VI	VII	VIII	IX	X	m	σ	CV
Ficus retusa	1994	5	3	2	6	4	4	4	1.4	35
	1995	8	6	6	2	2	8	5.3	2.7	50.9
Viburnum tinus	1994	0	0	0	0	0	4	0.7	1.6	228.6
	1995	0	0	0	3	8	0	1.8	3.3	183.3
Morus nigra	1994	0	1	1	-	-	-	0.3	0.5	166.7
	1995	2	0	3	-	-	2	1.2	1.3	108,3
Phoenix canariensis	1994	0	0	0	0	0	0	0	0	0
	1995	0	0	0	1	0	0	0.2	0.4	200
Laurus nobilis	1994	-	-	0	0	-	1	0.2	0.4	200
	1995	-	-	1	0	-	-	0.2	0.4	200
Cupressus sp.	1994	0	0	0	0	0	2	0.3	0.8	266.7
	1995	0	0	0	0	0	0	0	0	0
Phyllirea angustifolia	1994	0	0	1	0	-	1	0.3	0.5	166,7
	1995	0	0	0	0	-	-	0	0	0
Ind. species	1994	0	0	1	0	1	0	0.3	0.5	166.7
	1995	0	0	0	0	0	0	0	0	0
Total	1994	5	4	5	6	5	12	6.2	2.9	46.8
	1995	10	6	10	6	10	10	8.7	2.1	24.1
MF	1994	0.15	0.12	0.15	0.18	0.15	0.16	0.15	0.02	13.3
	1995	0.30	0.18	0.30	0.18	0.30	0.30	0.26	0.07	26.9

MF = an average number of fruits or fragments by faeces, the analysed number of faeces was 33 per month, except in October 1994, when it was 26; 0 when there are fruits and when these are not consumed; (-) when the plant does not fruit; m = average general; σ = standard deviation of the average; CV = coefficient of variation of the general average.

DISCUSSION

The variations of the number of preys per faeces are highest when the Spotted Flycatcher nourishes its chicks, and also at the time of its installation, just after its return. At the beginning of season, this number was regularly lower in 1995 than in 1994, to become wholly the same one in August and September. In the same way, the number of taxa per faeces was constantly lower in 1995 than in 1994, except in August, when it was the same (bad weather and few preys).

In spite of its variety, Spotted Flycatcher's diet in El Harrach was primarily based on Hymenopteras, which represent about half of the preys, and Coleopteras, which represent a little less than a fifth. This tendency to select Hymenopteras has been found for a certain number of other bird species in Algeria, in particular the Bee-eater (92.1%, Marniche *et al.*, 2007), the House Martin (85.7% including 82.7% of winged ants, Daoudi *et al.*, 2002) or the Kestrel (Souttou *et al.,* 2004). This is obviously related to the abundance of these Insects in the Mediterranean areas with a hot and dry summer. The absence of the domestic bee could be merely due to the fact that there were no hives in the vicinity. One can also think that its absence could be due to its large size as well as the fact that it stings. Captures of males *Vespula* have been reported, but close to the hives (Bauer & Glutz Von Blutzheim, 1993). The weak representation of the wasps goes in this direction. On the contrary, wild bees are rather well represented (6%), as well as Formicidae. These annual and monthly proportions are explained as much by the availability of the local food resources as by the specialized mode of hunting of the bird, which captures its preys in the foliage or when they fly, after a short pursuit (Davies, 1976, 1977; see also Erard, 1987 & Erard *et al.*, 1997). The scarcity of the representatives of certain taxonomic groups (Muscidae, Lepidopterans) can be explained besides by the difficulty of their capture.

Based on more than 90% of insects, Spotted Flycatcher's diet in our study area differs a little from that of other areas, *i.e.* England (Davies, 1976, 1977), Finland (Alatalo & Alatalo, 1979) or Kazakstan (Bannikova, 1986). There is also a clear similarity between the diets of this flycatcher in Spain, Crimea and Algeria: same prevalence of Hymenopterans, in similar proportions, and, in the case of Crimea, similar drops in their proportion in autumn. The proportion of ants in the Spotted Flycatcher's diet is respectively 18, 22.8 and 25.6% in these three countries. Coleopteras come in the second place in the three areas, but in fluctuating proportions, small in Algeria and high in Crimea. Dipteras account for small to negligible percentages, lower than 15%, while Hemipteras appear in small quantity only in Algeria.

On the contrary, the English Spotted Flycatcher has a diet where Hymenopteras are practically unknown (Tab. V) but where Dipteras represent more than two-thirds of the preys, and where Coleopteras as well as Hemipteras appear only in a small quantity. Obviously, this pattern appears linked to prey availability, e.g. the swarmings of ants, inter alia, being much less frequent in Europe than in Algeria.

TABLE V

Insects found (in %) in the diet of Spotted Flycatcher in various localities

Country Locality References	England Oxford (Davies, 1976, 1977) Faecal analysis		Spain (Jordano, 1981 *in* Cramp & Simmons,1993)	Ukraine Crimea (Kostin, 1983 *in* Cramp & Simmons, 1993)		Algeria Algiers Present study	
Period of study	Canopy-feeding (N = 71)	Flycatching (N = 1192)		Spring	Autumn	Spring	Autumn
Hymenoptera	0	0	54	51.8	41.5	50.5	41.3
Coleoptera	13	5	23	27.3	35.4	17.3	14.4
Diptera	63	75.1	14	10	4.6	13.9	13.8
Hemiptera	11	0	0	0	0	8.7	10.8

As shown by Jones (1976) and Davies (1977), it is especially the Spotted Flycatcher female which consumes non-insects invertebrates, Gastropods, Isopods, Myriapods and Arachnids, and this occurs in the days before egg-laying, when requirements in calcium are particularly high. Likewise, growing chicks have great requirements in calcium, which would explain why one sometimes finds the remains of non-insect invertebrates in their faeces (Davies, 1977).

The prevalence of the Tropical fig tree *F. retusa* among the fruits consumed by the Spotted Flycatcher in El-Harrach (Tab. IV) is also found in the menu of other birds of this locality, like the Blackbird *Turdus merula* (Doumandji & Doumandji-Mitiche, 1992) and the Common Bulbul *Pycnonotus barbatus* (Milla *et al.*, 2005). The fruits of the various tree-species are consumed as they become available, with a strong tendency to be better represented when the fruits of the fig-tree are less (Tab. IV). The maximum of fruit consumption occurs a little before the departure of the birds for their wintering zone (the fruits are good for the pre-migration fattening), like what was already noted in various areas of Europe for many other species (Blondel, 1969; Géroudet, 1980; Jay, 2000; Jordano, 1987 *in* Cramp & Simmons, 1993; Bauer & Glutz Von Blutzheim, 1993; Debussche & Isenmann, 1986).

In conclusion, we see here that in our Algerian site Spotted Flycatcher has a diet which differs from that of its congeners from other localities only in what is an adjustment to the local resources in insects and fruits, taking into account its mode of hunting with "sit-and-wait flycatching" or "foliage hover-gleaning".

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APPENDIX

Composition of the diet of Spotted Flycatcher Muscicapa striata *in 1994 and 1995 in a suburban locality of Algiers (n: number of specimens; n%: relative abundance of the considered taxon)*

	1994		1995		1994 / 95	
Taxa	n	n%	n	n%	n	n%
Arachnida, Araneidae sp.1, sp. 2, sp. 3, sp. 4	14	1.3	29	3.7	43	2.3
Gastropoda, Helicellidae sp.	3	0.3	2	0.3	5	0.3
Helicellidae, *Helicella* sp.	8	0.7	2	0.3	10	0.5
Crustacea, Isopoda sp.	9	0.8	9	1.1	18	1
Myriapoda, Diplopoda, Iulidae, *Iulus sp*	3	0.3	0	0	3	0.2
Hymenoptera sp.1	4	0.4	0	0	4	0.2
Hymenoptera sp.2, sp.3, sp.4, sp.5, sp.6	20	1.8	8	1	28	1.5
Hymenoptera sp.7	1	0.1	0	0	1	0.1
Hymenoptera sp.8	0	0	2	0.3	2	0.1
Apoidea sp.1, sp.2, sp.3	41	3.7	16	2	57	3
Apoidea sp.4	6	0.6	0	0	6	0.3
Apoidea sp.5, sp.6	26	2.4	7	0.9	33	1.7
Apoidea sp.7	1	0.1	0	0	1	0.1
Apoidea sp.8	8	0.7	5	0.6	13	0.7
Apoidea sp.9	2	0.2	0	0	2	0.1
Apoidea sp.10, sp.11	8	0.7	3	0.4	11	0.6
Apoidea sp.12, sp.13	13	1.2	0	0	13	0.7
Apidae sp.1, sp.2	45	4.1	69	8.7	114	6
Vespoidea sp.1, sp.2, sp.3, sp.4, sp.5, sp.6	21	1.9	22	2.8	43	2.3
Vespoidea sp.7, sp.8	0	0	2	0.3	2	0.1
Vespidae, *Vespa germanica*	8	0.7	23	2.9	31	1.6
Polistes gallicus	3	0.3	0	0	3	0.2
Ichneumonidea sp.1, sp.2, sp.3	10	0.9	7	0.9	17	0.9
Chalcidae sp.1, sp.2	7	0.6	6	0.8	13	0.7
Braconidae sp.1	3	0.3	2	0.3	5	0.3
Braconidae sp.2	0	0	1	0.1	1	0.1
Eumenidae sp.1	1	0.1	0	0	1	0.1
Eumenidae sp.2, sp.3	7	0.6	4	0.5	11	0.6
Chrysidae sp.	2	0.2	5	0.6	7	0.4
Chrysidae, *Chrysis* sp.	2	0.2	3	0.4	5	0.3
Sphecidae sp.	1	0.1	0	0	1	0.1
Sphecidae, *Crabro quinquenotatus*	2	0.2	2	0.3	4	0.2
Evaniidae, *Evania* sp.	1	0.1	1	0.1	2	0.1
Total Formicidae	340	31	142	18	482	25.6
Formicidae sp.1, sp.2,	22	2	2	0.3	24	1.3
Formicidae sp.3, sp.4, sp.5, sp.6	14	1.3	0	0	14	0.7
Formicidae, *Tapinoma simrothi*	51	4.7	26	3.3	77	4.1
Pheidole pallidula	44	4	23	2.9	67	3.5

	1994		1995		1994 / 95	
Taxa	n	n%	n	n%	n	n%
Tetramorium biskrensis	101	9.2	5	0.6	106	5.6
Tetramorium sp.	1	0.1	0	0	1	0.1
Plagiolepis arbara	18	1.6	13	1.6	31	1.6
Aphenogaster sp.	8	0.7	0	0	8	0.4
Aphenogaster testaceo pilosa	20	1.8	36	4.6	56	3
Camponotus sp.	1	0.1	0	0	1	0.1
Camponotus barbaricus xanthomelas	2	0.2	1	0.1	3	0.2
Cataglyphis bicolor	16	1.5	17	2.2	33	1.7
Monomorium salomonis	18	1.6	5	0.6	23	1.2
Crematogaster sp.	1	0.1	0	0	1	0.1
Crematogaster scutellaris	4	0.4	7	0.9	11	0.6
Messor barbara	19	1.7	7	0.9	26	1.4
Coleoptera sp.1, sp.2, sp.3, sp.4, sp.5, sp.6, sp.7	39	3.6	23	2.9	62	3.3
Coleoptera sp.8	2	0.2	0	0	2	0.1
Coleoptera sp.9, sp.10, sp.11	13	1.2	8	1	21	1.1
Coleoptera sp.12, sp.13	0	0	5	0.6	5	0.3
Carpophilidae sp.1, sp.2	6	0.6	3	0.4	9	0.5
Carpophilidae sp.3, sp.4	0	0	7	0.9	7	0.4
Scolytidae sp.1, sp.2	2	0.2	3	0.4	5	0.3
Scolytidae sp.3	4	0.4	0	0	4	0.2
Scolytidae, *Coccotrypes dactyliperda*	19	1.7	16	2	35	1.9
Cicindellidae, *Cicindella* sp.	0	0	1	0.1	1	0.1
Curculionidae sp.1, sp.2	10	0.9	3	0.4	13	0.7
Curculionidae sp.3	5	0.5	0	0	5	0.3
Curculionidae, *Apion* sp.1	13	1.2	2	0.3	15	0.8
Apion sp.2	2	0.2	0	0	2	0.1
Baridius quadriticullis	1	0.1	0	0	1	0.1
Sitona sp.	1	0.1	0	0	1	0.1
Staphylinidae sp.1, sp.2	10	0.9	0	0	10	0.5
Staphylinidae sp.3	1	0.1	4	0.5	5	0.3
Staphylinidae, *Staphylinus* sp.	1	0.1	0	0	1	0.1
Bruchidae sp.1	5	0.5	4	0.5	9	0.5
Bruchidae sp.2	5	0.5	0	0	5	0.3
Buprestidae sp.1, sp.2	3	0.3	10	1.3	13	0.7
Buprestidae, *Anthaxia* sp.	1	0.1	0	0	1	0.1
Chrysomelidae sp.1, sp.2	10	0.9	15	1.9	25	1.3
Chrysomelidae, *Cassida* sp.	2	0.2	0	0	2	0.1
Carabidae sp.1	3	0.3	2	0.3	5	0.3
Carabidae sp.2	3	0.3	0	0	3	0.2
Carabidae sp.3, sp.4	4	0.4	3	0.4	7	0.4
Carabidae sp.5	1	0.1	0	0	1	0.1
Scarbeidae sp.1, sp.2	4	0.4	13	1.6	17	0.9
Scarbeidae sp.3, sp.4	0	0	3	0.4	3	0.2

	1994		1995		1994 / 95	
Taxa	n	n%	n	n%	n	n%
Scarbeidae, *Rhizotrogus* sp.	1	0.1	0	0	1	0.1
Hoplia sulfurea	1	0.1	0	0	1	0.1
Aphodius sp.	2	0.2	5	0.6	7	0.4
Onthophagus sp.	1	0.1	0	0	1	0.1
Tenebrionidae sp.	7	0.6	0	0	7	0.4
Cerambicidae sp.	1	0.1	0	0	1	0.1
Elateridae sp.	1	0.1	0	0	1	0.1
Dermestidae sp.	2	0.2	0	0	2	0.1
Histeridae sp.	4	0.4	0	0	4	0.2
Silvanidae sp.	1	0.1	0	0	1	0.1
Drillidae, *Drillus mauritanicus*	1	0.1	0	0	1	0.1
Coccinellidae sp.	1	0.1	0	0	1	0.1
Coccinellidae, *Scymnus* sp.	1	0.1	0	0	1	0.1
Coccinella algerica	0	0	3	0.4	3	0.2
Adonia variegata	0	0	1	0.1	1	0.1
Harmonia doublieri	0	0	1	0.1	1	0.1
Phalacridae, *Olibrius* sp.	1	0.1	0	0	1	0.1
Anthribidae sp.	1	0.1	0	0	1	0.1
Diptera sp.1	5	0.5	0	0	5	0.3
Diptera sp.2, sp.3, sp.4, sp.5	45	4.1	26	3.3	71	3.8
Diptera sp.6, sp.7, sp.8, sp.9	4	0.4	0	0	4	0.2
Calliphoridae sp.	0	0	4	0.5	4	0.2
Calliphoridae, *Lucilia* sp.	60	5.5	81	10.2	141	7.5
Calliphora sp.	0	0	2	0.3	2	0.1
Syrphidae sp.	2	0.2	0	0	2	0.1
Syrphidae, *Syrphus balteatus*	2	0.2	0	0	2	0.1
Cyclorrrhaphes sp.	5	0.5	0	0	5	0.3
Hemiptera sp.1, sp.2, sp.3	29	2.6	0	0	29	1.5
Hemiptera sp.4, sp.5, sp. 6	10	0.9	16	2	26	1.4
Coreidae sp.	7	0.6	35	4.4	42	2.2
Cydninae sp.	20	1.8	10	1.3	30	1.6
Tingidae sp.	1	0.1	0	0	1	0.1
Reduviidae sp.	1	0.1	0	0	1	0.1
Pentatomidae sp.	29	2.6	42	5.3	71	3.8
Pentatomidae, *Nezara viridula*	3	0.3	8	1	11	0.6
Pentatomorphe sp.	0	0	1	0.1	1	0.1
Sciocoris sp.	0	0	3	0.4	3	0.2
Lepidoptera sp.1, sp.2	7	0.6	0	0	7	0.4
Noctuidae sp.1, sp.2	13	1.2	30	3.8	43	2.3
Noctuidae sp. 3	2	0.2	0	0	2	0.1
Homoptera sp. 1, sp. 2	4	0.4	0	0	4	0.2
Cicadellidae sp. 1, sp. 2	4	0.4	5	0.6	9	0.5
Cicadellidae sp. 3.	1	0.1	0	0	1	0.1

	1994		1995		1994 / 95	
Taxa	n	n%	n	n%	n	n%
Cicadidae, *Tettigia orni*	1	0.1	0	0	1	0.1
Cicadidae, *Lepidosaphes* sp.	1	0.1	0	0	1	0.1
Embioptera sp.1	7	0.6	10	1.3	17	0.9
Embioptera sp.2, sp.3	3	0.3	0	0	3	0.2
Orthoptera sp.	2	0.2	0	0	2	0.1
Caelifera sp.	3	0.3	4	0.5	7	0.4
Catantopidae, *Pezottetix giornai*	3	0.3	4	0.5	7	0.4
Tetrigidae, *Paratettix meridionalis*	1	0.1	0	0	1	0.1
Ensifera, Gryllidae sp.	1	0.1	0	0	1	0.1
Dermaptera sp.	1	0.1	1	0.1	2	0.1
Labiduridae*, Anisolabis mauritanicus*	2	0.2	3	0.4	5	0.3
Dictyoptera, Blattoptera sp.	2	0.2	0	0	2	0.1
Total of animals	1097	96.7	792	95	1889	96
Total of taxa	179		124		196	
Ficus retusa	24	64.9	24	60	48	60.8
Viburnum tinus	4	10.8	11	22.5	15	19
Morus nigra	2	5.4	5	12.5	7	8.9
Cupressus sp.	2	5.4	0	0	2	2.5
Laurus nobilis	1	2.7	1	2.5	2	2.5
Phillyrea angustifolia	2	5.4	0	0	2	2.5
Phoenix canariensis	0	0	1	2.5	1	1.3
ind. Species	2	5.4	0	0	2	2.5
Total of plants	37	3.3	42	5	79	4
Total of taxa	7		5		8	
Totals animals and plants	1134	100	834	100	1968	100